MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

BZX79C2V4RL SERIES

500 mW DO-35 GLASS

500 mW DO-35 Glass
Zener Voltage Regulator Diodes

GENERAL DATA APPLICABLE TO ALL SERIES IN THIS GROUP

500 Milliwatt Hermetically Sealed Glass Silicon Zener Diodes

GLASS ZENER DIODES
500 MILLIWATTS
1.8–200 VOLTS

CASE 299
DO-204AH
GLASS

Specification Features:

- Complete Voltage Range — 1.8 to 200 Volts
- DO-204AH Package — Smaller than Conventional DO-204AA Package
- Double Slug Type Construction
- Metallurgically Bonded Construction

Mechanical Characteristics:

CASE: Double slug type, hermetically sealed glass
MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES: 230°C, 1/16″ from case for 10 seconds
FINISH: All external surfaces are corrosion resistant with readily solderable leads
POLARITY: Cathode indicated by color band. When operated in zener mode, cathode will be positive with respect to anode
MOUNTING POSITION: Any
WAFER FAB LOCATION: Phoenix, Arizona
ASSEMBLY/TEST LOCATION: Seoul, Korea

MAXIMUM RATINGS (Motorola Devices)*

Rating	Symbol	Value	Unit
DC Power Dissipation and $T_L \le 75°C$ Lead Length = 3/8″ Derate above $T_L = 75°C$	P_D	 500 4	 mW mW/°C
Operating and Storage Temperature Range	T_J, T_{stg}	– 65 to +200	°C

* Some part number series have lower JEDEC registered ratings.

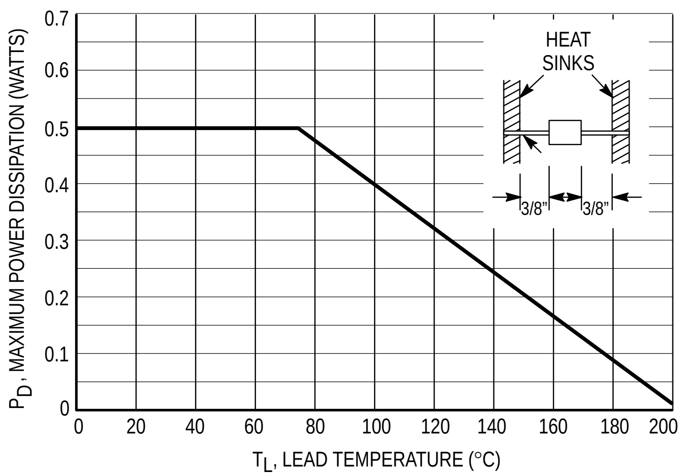


Figure 1. Steady State Power Derating

GENERAL DATA — 500 mW DO-35 GLASS

***ELECTRICAL CHARACTERISTICS** (T_L = 30°C unless otherwise noted.) (V_F = 1.5 Volts Max @ I_F = 100 mAdc for all types.)

Device Type (Note 2)	Zener Voltage (Note 1) (Note 4)			Impedance (Ohm) @ I_{ZT} f = 1000 Hz	Leakage Current (μA)		Temp. Coefficient (Typical) (mV/°C)		Capacitance (Typical) (pF) V_R = 0, f = 1.0 MHz
	Min	Max	I_{ZT} = (mA)	Max (Note 3)	Max	@ V_R = (Volt)	Min	Max	
BZX79C2V4RL	2.2	2.6	5	100	100	1	–3.5	0	255
BZX79C3V3RL	3.1	3.5	5	95	25	1	–3.5	0	200
BZX79C3V6RL	3.4	3.8	5	90	15	1	–3.5	0	185
BZX79C3V9RL	3.7	4.1	5	90	10	1	–3.5	+0.3	175
BZX79C4V7RL	4.4	5	5	80	3	2	–3.5	+0.2	130
BZX79C5V1RL	4.8	5.4	5	60	2	2	–2.7	+1.2	110
BZX79C5V6RL	5.2	6	5	40	1	2	–2	+2.5	95
BZX79C6V2RL	5.8	6.6	5	10	3	4	0.4	3.7	90
BZX79C6V8RL	6.4	7.2	5	15	2	4	1.2	4.5	85
BZX79C7V5RL	7	7.9	5	15	1	5	2.5	5.3	80
BZX79C8V2RL	7.7	8.7	5	15	0.7	5	3.2	6.2	75
BZX79C10RL	9.4	10.6	5	20	0.2	7	4.5	8	70
BZX79C12RL	11.4	12.7	5	25	0.1	8	6	10	65
BZX79C15RL	13.8	15.6	5	30	0.05	10.5	9.2	13	55
BZX79C18RL	16.8	19.1	5	45	0.05	12.6	12.9	16	47
BZX79C22RL	20.8	23.3	5	55	0.05	15.4	16.4	20	34
BZX79C24RL	22.8	25.6	5	70	0.05	16.8	18.4	22	33
BZX79C27RL	25.1	28.9	2	80	0.05	18.9		23.5	30
BZX79C30RL	28	32	2	80	0.05	21		26	27
BZX79C33RL	31	35	2	80	0.05	23.1		29	25

NOTE 1. Zener voltage is measured under pulse conditions such that T_J is no more than 2°C above T_A.

NOTE 2. TOLERANCE AND VOLTAGE DESIGNATION

Tolerance designation —– The type numbers listed have zener voltage min/max limits as shown. Device tolerances of ±2% are indicated by a “B” instead of a “C,” and ±1% by “A.”

NOTE 3. Z_{ZT} is measured by dividing the ac voltage drop across the device by the ac current applied. The specified limits are for I_Z(ac) = 0.1 I_Z(dc) with the ac frequency = 1.0 kHz.

APPLICATION NOTE — ZENER VOLTAGE

Since the actual voltage available from a given zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature, T_L, should be determined from:

$$T_L = \theta_{LA} P_D + T_A.$$

θ_{LA} is the lead-to-ambient thermal resistance (°C/W) and P_D is the power dissipation. The value for θ_{LA} will vary and depends on the device mounting method. θ_{LA} is generally 30 to 40°C/W for the various clips and tie points in common use and for printed circuit board wiring.

The temperature of the lead can also be measured using a thermocouple placed on the lead as close as possible to the tie point. The thermal mass connected to the tie point is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady-state conditions are achieved. Using the measured value of T_L, the junction temperature may be determined by:

$$T_J = T_L + \Delta T_{JL}.$$

ΔT_{JL} is the increase in junction temperature above the lead temperature and may be found from Figure 2 for dc power:

$$\Delta T_{JL} = \theta_{JL} P_D.$$

For worst-case design, using expected limits of I_Z, limits of P_D and the extremes of $T_J(\Delta T_J)$ may be estimated. Changes in voltage, V_Z, can then be found from:

$$\Delta V = \theta_{VZ} T_J.$$

θ_{VZ}, the zener voltage temperature coefficient, is found from Figures 4 and 5.

Under high power-pulse operation, the zener voltage will vary with time and may also be affected significantly by the zener resistance. For best regulation, keep current excursions as low as possible.

Surge limitations are given in Figure 7. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots, resulting in device degradation should the limits of Figure 7 be exceeded.

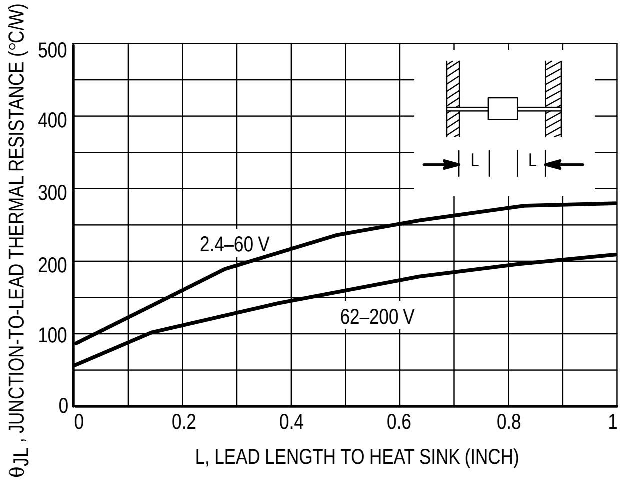


Figure 2. Typical Thermal Resistance

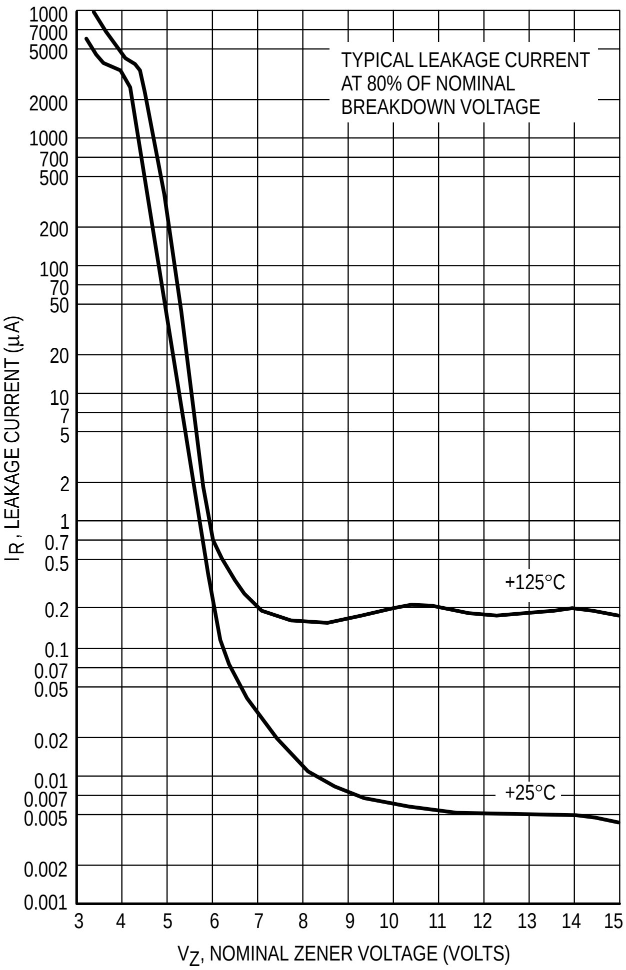


Figure 3. Typical Leakage Current

TEMPERATURE COEFFICIENTS

(–55°C to +150°C temperature range; 90% of the units are in the ranges indicated.)

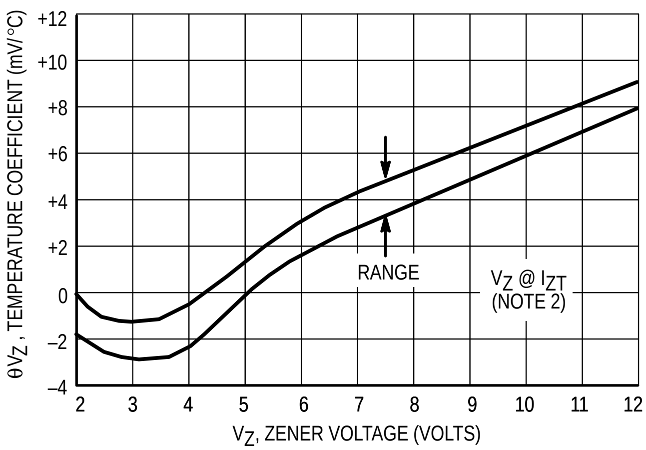


Figure 4a. Range for Units to 12 Volts

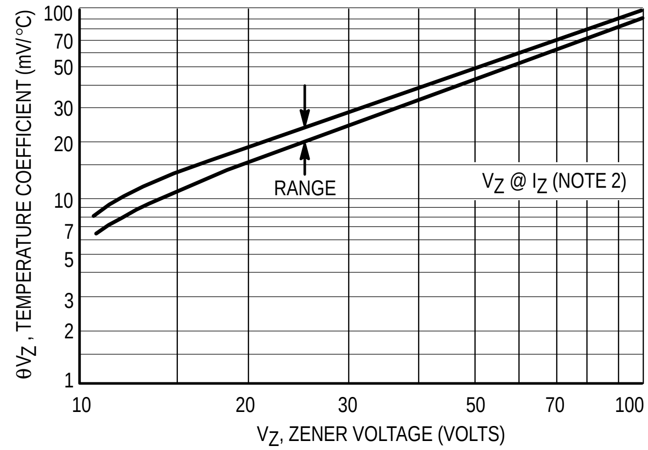


Figure 4b. Range for Units 12 to 100 Volts

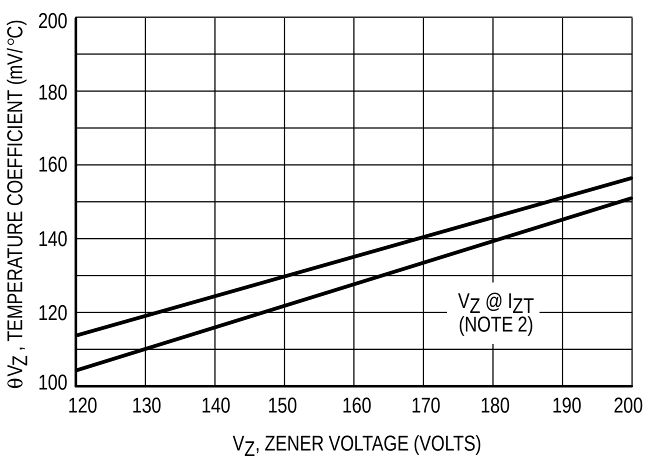


Figure 4c. Range for Units 120 to 200 Volts

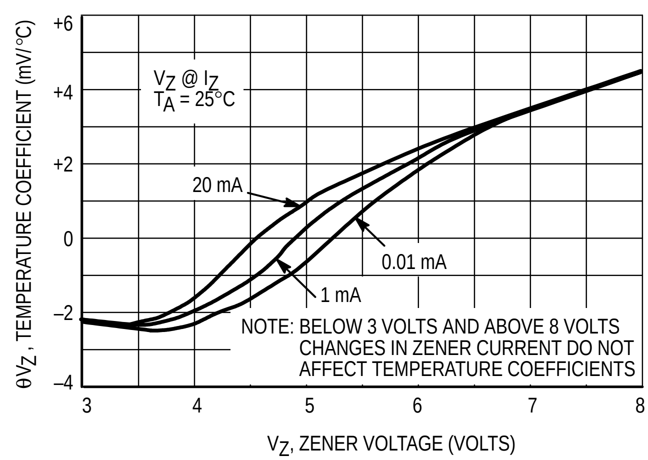


Figure 5. Effect of Zener Current

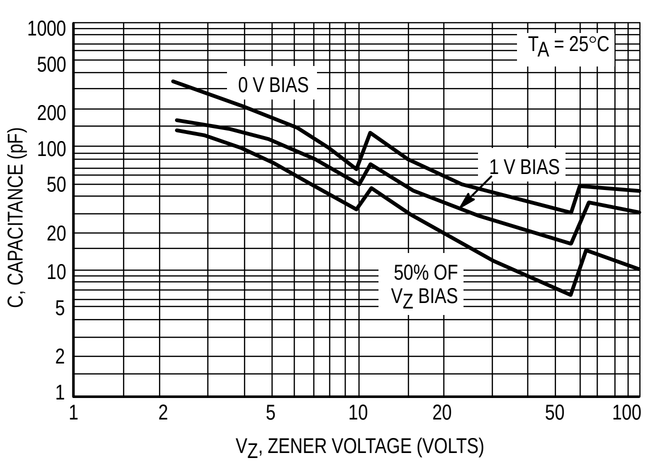


Figure 6a. Typical Capacitance 2.4–100 Volts

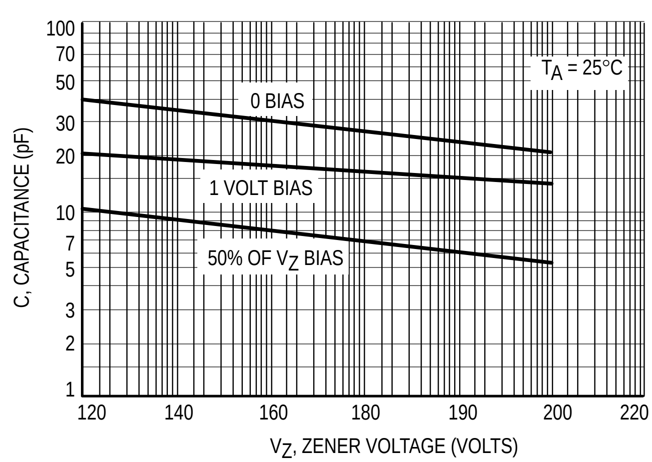


Figure 6b. Typical Capacitance 120–200 Volts

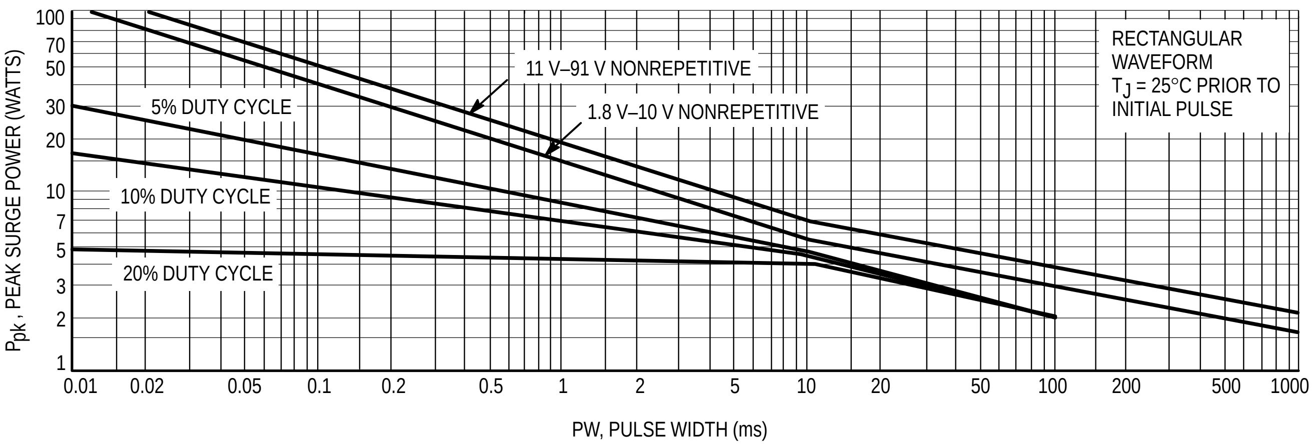


Figure 7a. Maximum Surge Power 1.8–91 Volts

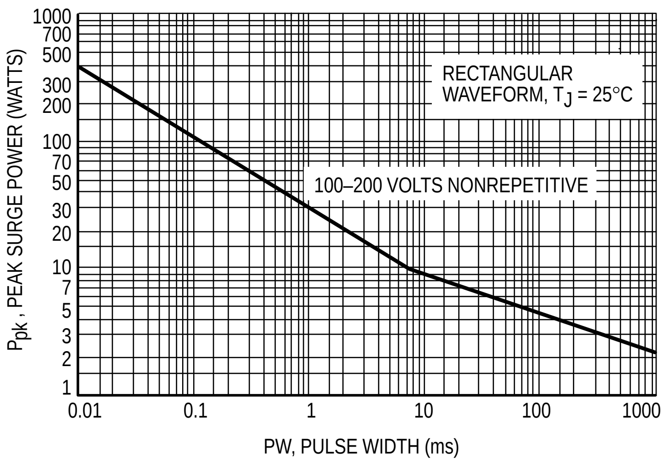


Figure 7b. Maximum Surge Power DO-204AH 100–200 Volts

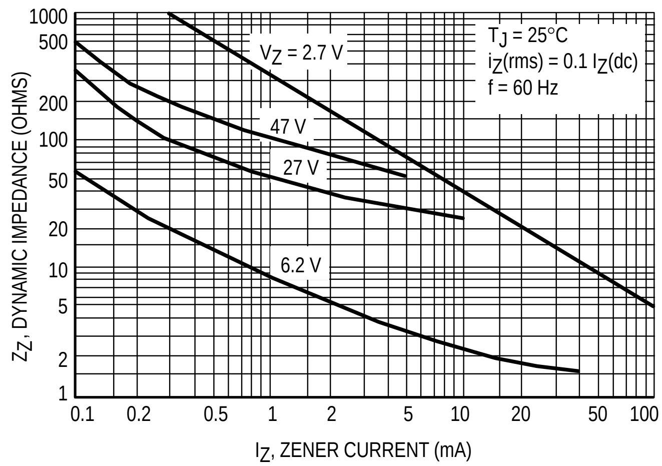


Figure 8. Effect of Zener Current on Zener Impedance

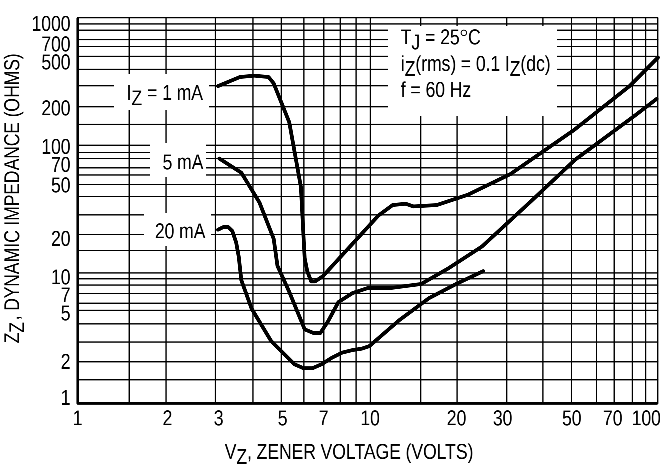


Figure 9. Effect of Zener Voltage on Zener Impedance

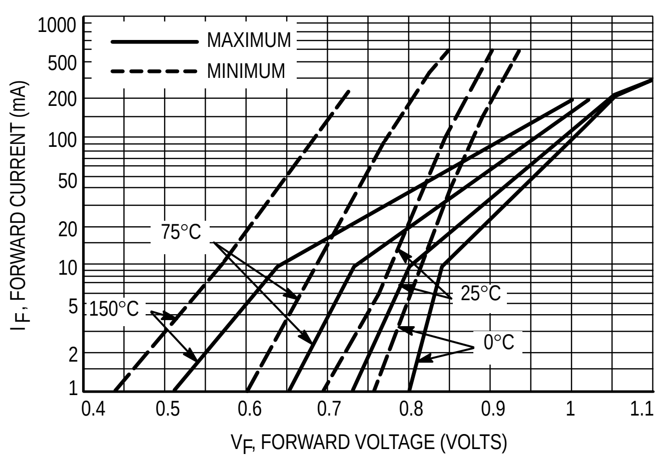


Figure 10. Typical Forward Characteristics

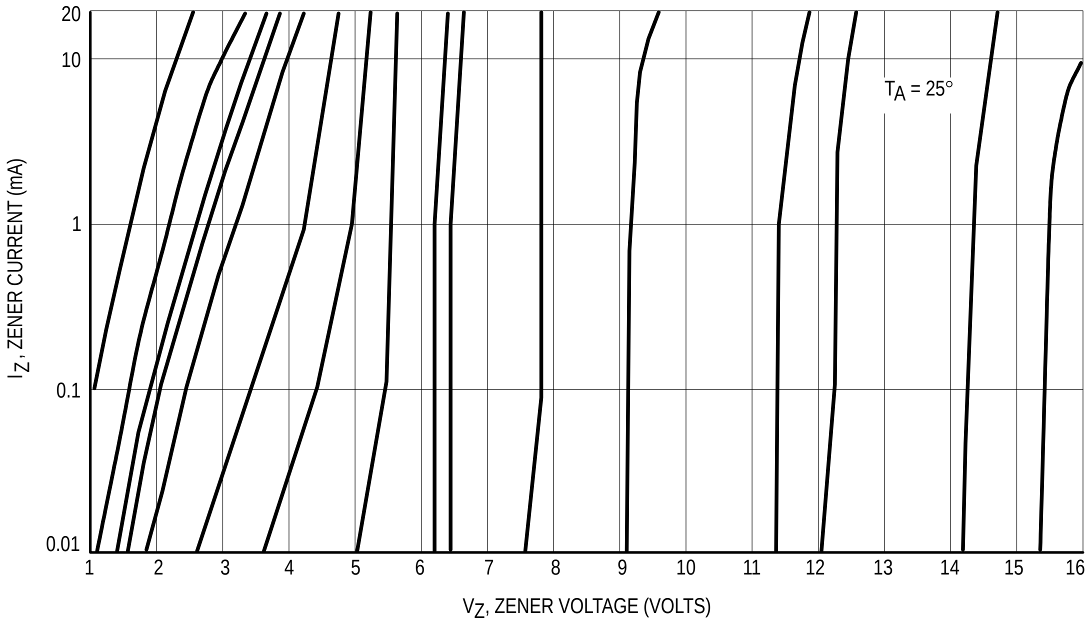


Figure 11. Zener Voltage versus Zener Current — V_Z = 1 thru 16 Volts

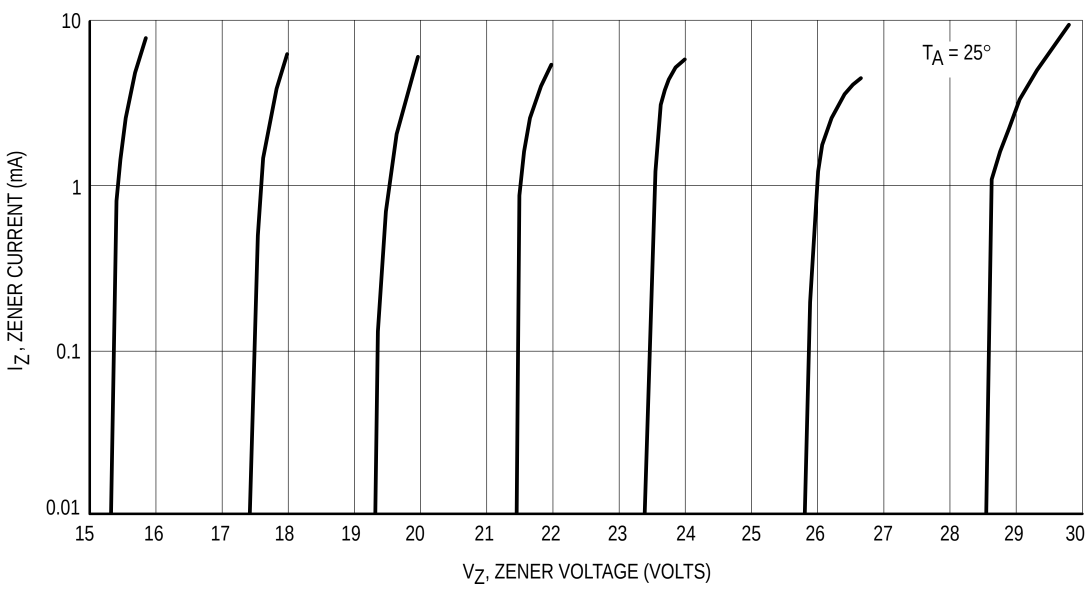


Figure 12. Zener Voltage versus Zener Current — V_Z = 15 thru 30 Volts

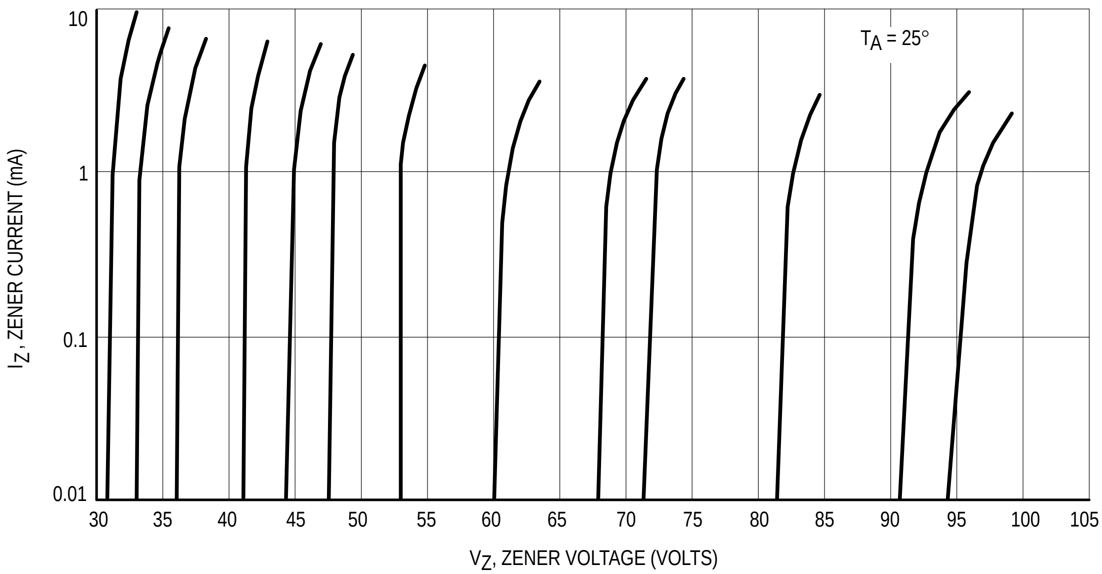


Figure 13. Zener Voltage versus Zener Current — V_Z = 30 thru 105 Volts

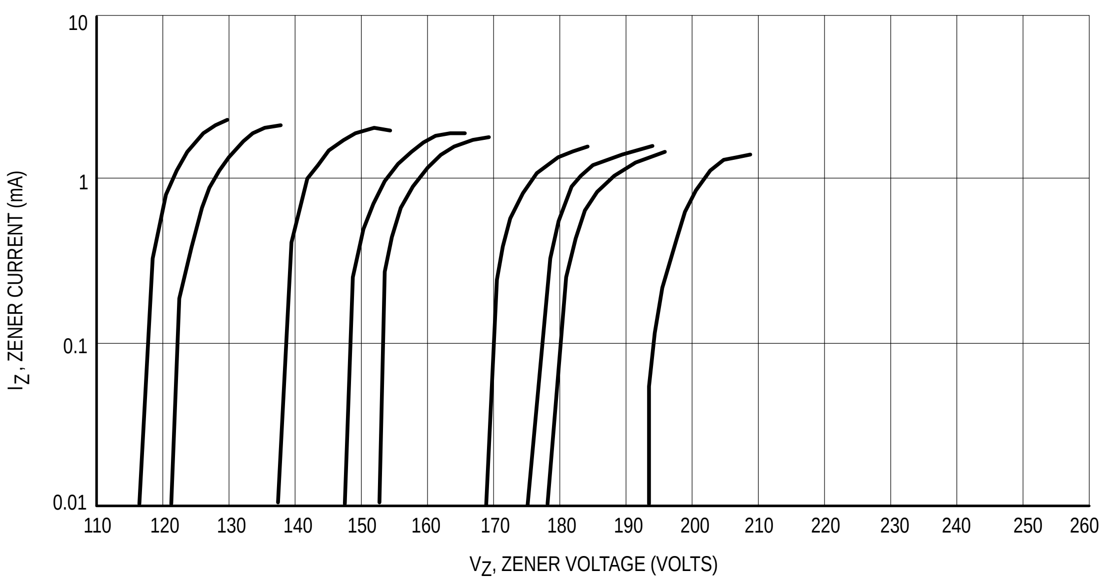
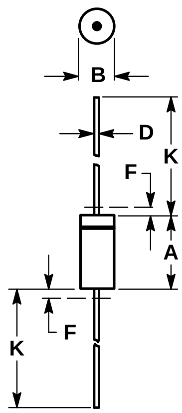


Figure 14. Zener Voltage versus Zener Current — V_Z = 110 thru 220 Volts

Zener Voltage Regulator Diodes — Axial Leaded

500 mW DO-35 Glass



NOTES:
1. PACKAGE CONTOUR OPTIONAL WITHIN A AND B HEAT SLUGS, IF ANY, SHALL BE INCLUDED WITHIN THIS CYLINDER, BUT NOT SUBJECT TO THE MINIMUM LIMIT OF B.
2. LEAD DIAMETER NOT CONTROLLED IN ZONE F TO ALLOW FOR FLASH, LEAD FINISH BUILDUP AND MINOR IRREGULARITIES OTHER THAN HEAT SLUGS.
3. POLARITY DENOTED BY CATHODE BAND.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	3.05	5.08	0.120	0.200
B	1.52	2.29	0.060	0.090
D	0.46	0.56	0.018	0.022
F	—	1.27	—	0.050
K	25.40	38.10	1.000	1.500

All JEDEC dimensions and notes apply.

CASE 299-02
DO-204AH
GLASS

(Refer to Section 10 for Surface Mount, Thermal Data and Footprint Information.)

MULTIPLE PACKAGE QUANTITY (MPQ) REQUIREMENTS

Package Option	Type No. Suffix	MPQ (Units)
Tape and Reel	RL, RL2(1)	5K
Tape and Ammo	TA, TA2(1)	5K

NOTES: 1. The “2” suffix refers to 26 mm tape spacing.
2. Radial Tape and Reel may be available. Please contact your Motorola representative.

Refer to Section 10 for more information on Packaging Specifications.